55

$$W = Pv + \frac{V\delta v^2}{2g}$$

$$W = a + \frac{b}{g}$$

$$dW = -\frac{b}{g^2} \cdot dg$$

$$\frac{dW_{mars}}{dW_{earth}} = \frac{\frac{-b}{5.2^2}\,dg}{\frac{-b}{32^2}\,dg} = \frac{\frac{-1}{5.2^2}}{\frac{-1}{32^2}} = \frac{32^2}{5.2^2}$$

$$\approx 37.8 \approx 38$$

Nov 3-10:19 AM

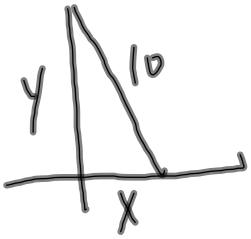
4.6 related rates (derivative wrt time)

2 or more variables that change over time t

the variables are related so their derivatives are related. given 1 derivatwe find the othe derivatwe

ex.

10 ft ladder



$\frac{dx}{dt} = 2\ \frac{ft}{sec}$ is $\frac{dy}{dt}$ constant?

$x^2 + y^2 = 10^2$ take der wrt t

$$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0 \qquad \frac{dy}{dt} = -\frac{x}{y}\cdot 2$$

Nov 3-11:43 AM

How fast is the top moving when the bottom is 4 ft from the wall? $x=4$ $y=\sqrt{10^2-4^2}$

$$\frac{dy}{dt} = \frac{-2\cdot 4}{\sqrt{10^2-4^2}} = -.8729 \ \frac{ft}{sec}$$

$$\frac{dy}{dt} = \frac{-x\cdot 2}{y}$$

going down

also y is decreasing

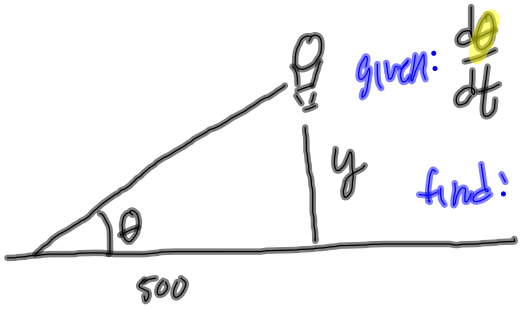
Nov 3-11:58 AM

p246, 247 strategy

1. understand the problem
   what should we find, what's given
2. pic, label variables
3. equation
4. derivative wrt t
5. solve for the derivative we want
   substitute, get answer

Nov 3-12:01 PM

Ex 2



given: $\frac{d\theta}{dt} = .14$ rad/min

find: $\frac{dy}{dt}$ ↑ how fast the ballon rises

$\tan\theta = \frac{y}{500}$

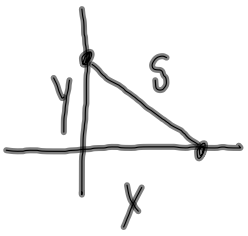
$y = 500\tan\theta$ derivative w.r.t. t

$\frac{dy}{dt} = 500 \cdot \sec^2\theta \frac{d\theta}{dt}$

$\frac{dy}{dt} = 500 \sec^2\left(\frac{\pi}{4}\right)(.14) = 140 \frac{ft}{\cancel{sec}\ min}$

Nov 3-12:04 PM

Ex 3



$\frac{ds}{dt} = 20$ $\frac{dy}{dt} = 60$

$\frac{dx}{dt} = ?$

$x = .6$

$y = .8$

$s = ?$

$s^2 = x^2 + y^2$ take derivative w.r.t. t

$2s\frac{ds}{dt} = 2x\frac{dx}{dt} + 2y\frac{dy}{dt}$

$s = \sqrt{.6^2 + .8^2}$

$s = 1$

$1 \cdot 20 = .6\frac{dx}{dt} + .8 \cdot 60$

$\frac{dx}{dt} = 70$ mph don't forget units

Nov 3-12:14 PM